MAR 4 1988

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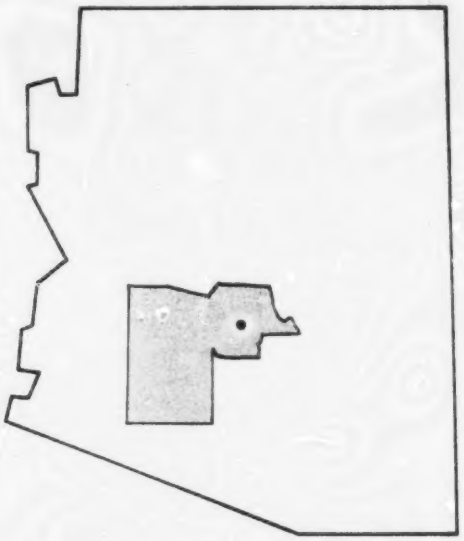
FLOOD INSURANCE STUDY

COMPLETED
36

ORIGINAL

TOWN OF PARADISE VALLEY, ARIZONA
MARICOPA COUNTY



JUNE 3, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 040049

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Flood Insurance Rate Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study report has been prepared to revise and update a previous Flood Insurance Study/Flood Insurance Rate Map for the Town of Paradise Valley, Maricopa County, Arizona (Reference 1). This information will be used by Paradise Valley to update existing flood plain regulations as part of the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). The information will also be used by local and regional planners to further promote sound land use and flood plain development.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the original study were performed by U.S. Geological Survey (USGS) for FEMA, under Inter-Agency Agreement No. IAA-H-20-74, Project Order No. 16. This work was completed in 1976.

The hydrologic analysis for Indian Bend Wash was revised by the U.S. Army Corps of Engineers (COE) in 1978.

The hydraulic analysis for Indian Bend Wash was revised by Harris-Toups Associates, for FEMA, under Contract No. H-4008. This work was also completed in 1978.

The hydrologic analysis for Berneil Channel was revised by Collar, Williams and White Engineering, Inc., in 1978.

The hydrologic analysis for Indian Bend Wash for this study was revised by the COE in 1981.

The hydraulic analyses for Berneil Channel and Indian Bend Wash for this study were revised by PRC Engineering for FEMA under Contract No. EMW-R-83C1193 in 1984.

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1.3 Coordination

A search was made on all levels of government for information pertinent to this study. The COE, Los Angeles District, furnished maps, reports, and flood data for use in the study.

On June 4, 1984, a final Consultation Coordination Officer (CCO) meeting was held to present the results of this study to the community. At the meeting were representatives of the Town of Paradise Valley, FEMA, and the study contractor.

The COE, Los Angeles District, also furnished maps, reports, and flood data for use in the previous study. The U.S. Bureau of Reclamation and the U.S. Soil Conservation Service were also consulted for relevant information.

The final community coordination meeting for the previous study was held on May 3, 1979. At the meeting were representatives of the Town of Paradise Valley, FEMA, and the study contractor.

The final community coordination meeting for this study was held on June 4, 1984, and was attended by representatives of FEMA, the study contractor, and the town. No problems were raised at the meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Paradise Valley, Maricopa County, Arizona. The area of study is shown on the Vicinity Map (Figure 1).

Detailed methods were used to study Indian Bend Wash, Berneil Channel, and most of Echo Canyon Wash.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1990.

A small portion of Echo Canyon Wash and the Arizona Canal were studied by approximate methods. The flood boundaries of Echo Canyon Wash and the Arizona Canal were adopted directly from the 1979 Flood Insurance Study (Reference 1).

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Paradise Valley.

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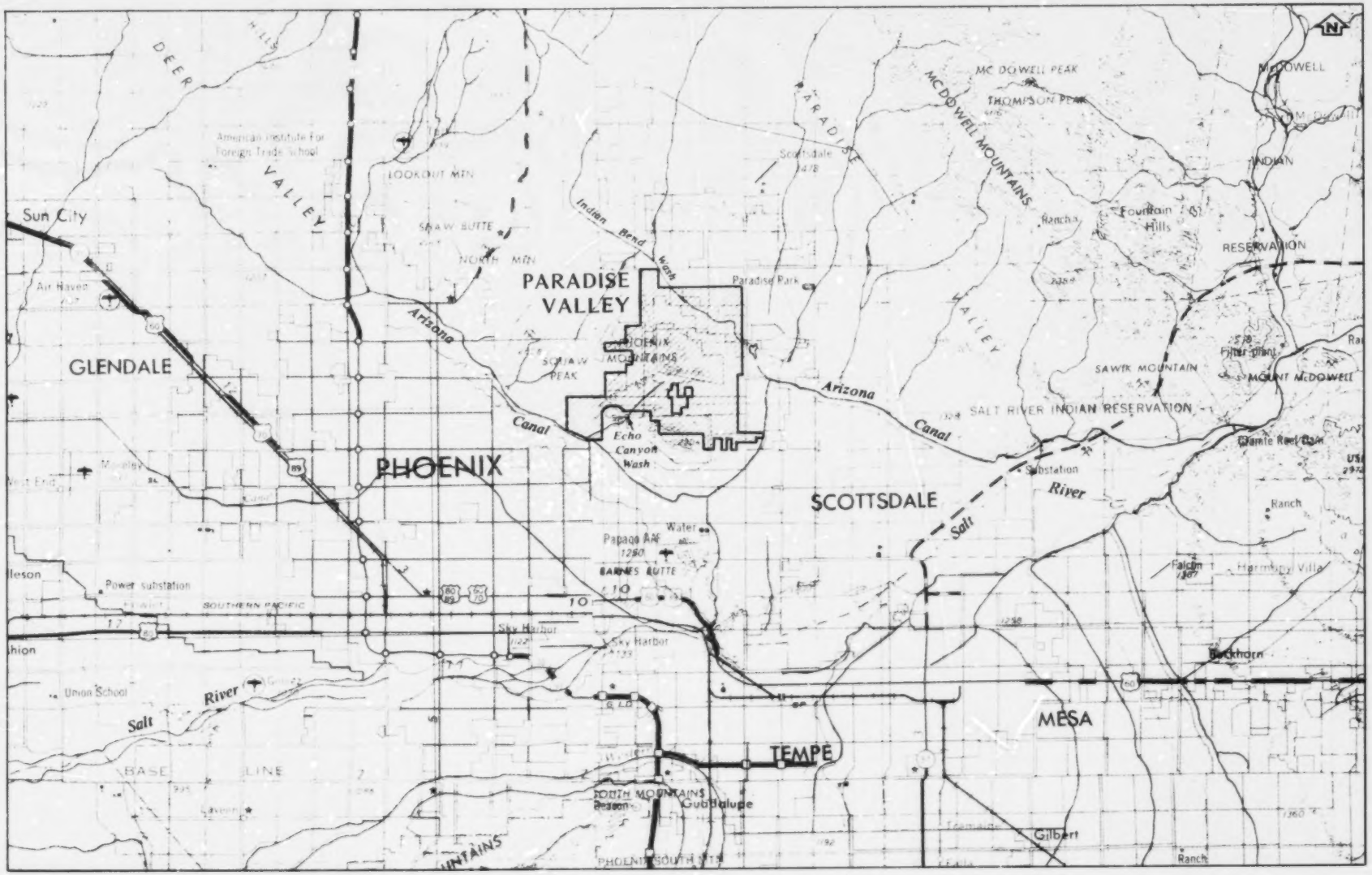

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PARADISE VALLEY, AZ
(MARICOPA CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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2.2 Community Description

Paradise Valley, a residential suburb of Phoenix located in southern Maricopa County, southwestern Arizona, was incorporated in May 1961. It has high-quality resorts, small groupings of neighborhood shops, no large industrial areas, and few commercial developments. According to the 1970 census, the population was less than 7,200. The town, however, is growing rapidly. In 1984 the population was estimated at 12,700.

The Town of Paradise Valley is situated between the City of Scottsdale on the east and the City of Phoenix on the west; Phoenix also borders the north and south corporate limits. Paradise Valley can only expand into small isolated areas that have remained unincorporated. The small areas are completely surrounded by Paradise Valley, Scottsdale, or Phoenix.

The town is located at the eastern end of a group of low rocky hills known as the Phoenix Mountains, its land ranging in elevation from 1,250 to 2,430 feet. The drainage basins of the streams draining into Paradise Valley reach elevations of approximately 3,200 feet. Within the corporate limits are a broad swale-type flood plain, alluvial plains, and steep, bare, rocky hills.

Indian Bend Wash flows through the northeastern corner of town along the south side of the large alluvial valley between the McDowell and Phoenix Mountains. Berneil Channel collects and carries floodwaters from adjacent communities to the northeast to Indian Bend Wash.

Echo Canyon Wash is located near the southwestern corner of town and carries runoff southwesterly to the Arizona Canal.

The climate of Paradise Valley ranges from warm and arid over the desert to cool and moderately humid in the mountain areas. Average monthly summer temperatures range from 78°F to 105°F, while average monthly winter temperatures range from 38° to 65°F. Average annual rainfall is 9.5 inches. Flood plain development in Paradise Valley is residential.

2.3 Principal Flood Problems

Indian Bend Wash constitutes the primary flood hazard. Berneil Channel has been recently improved to contain large amounts of flow; however, the upstream portion of the channel which parallels Mountain View Road has not been upgraded. Approximately 1,000 cubic feet per second (cfs) will break out of the south bank and flow southerly.

In general, the tributaries along the south side of the alluvial valley are less than 3 miles long and have drainage areas of less

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than 2 square miles. The north side of the valley is an alluvial plain extending about 20 miles from the McDowell Mountains to Indian Bend Wash, with a gradient of about 30 feet per mile. The few existing channels in the alluvial plain are small and poorly defined, and floodwater moves overland as sheetflow. The alluvial plain is an area where rapid development is anticipated in the next few years. Extensive urbanization of the area outside of Paradise Valley may greatly alter the frequency and magnitude of floods in the town (Reference 2). Floodwater from the north formerly entered Indian Bend Wash as sheetflow throughout most of its 2.6-mile reach through the study area. Berneil Channel now intercepts most of the runoff that formerly entered Indian Bend Wash between this channel and Scottsdale Road. In Paradise Valley, concentrated flow enters the wash only at Berneil Channel and the drainage ditch near Invergordon Bridge.

The past history of flooding on the streams within Paradise Valley indicates that flooding may occur during any season of the year. Three types of storms that cause flooding in the Paradise Valley region are general winter storms, general summer storms, and local thunderstorms.

General winter storms, which occur between December and March, originate over the Pacific Ocean and move eastward. Sizeable floods were caused by winter storms in Paradise Valley in February 1884, February 1891, January 1916, and February-March 1938, but there are no adequate records of severity or damage.

General summer storms occur from July to September and are often accompanied by heavy rainfall over large areas for up to 24 hours, with light showers continuing for as long as 3 days. One of the worst storms on record for the Phoenix area occurred in August 1943. Heavy rains caused a series of 22 breaks in the south bank levee of the Arizona Canal in the vicinity of Indian Bend Wash, and a break in the south bank of the canal in the Cave Creek area released water that caused nine breaks in the Grand Canal. The total peak inflow into the Arizona Canal was estimated at 30,000 cfs and in Cave Creek upstream of the Arizona Canal, the flow was estimated at 9,000 cfs. The maximum peak discharge in Indian Bend Wash at the Arizona Canal was estimated at 15,000 cfs (Reference 3).

In June 1972, a series of intense thunderstorms dumped up to 5 inches of rain in approximately 2 hours in the Phoenix area. This rainfall caused shallow flooding of large areas in Paradise Valley and on the southwestern slopes of the McDowell Mountains. Flooding occurred upstream of the Arizona Canal when floodwaters ponded behind the canal levee. Most damage downstream of the Arizona Canal resulted from breaks in the canal caused by overtopping (Reference 2). Echo Canyon Wash overflowed its banks, damaged several homes in Phoenix, and deposited large amounts of gravel

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and rock debris upstream from the Arizona Canal. Peak discharges of 3,000 cfs from 2.94 square miles and 244 cfs from 0.08 square miles were measured in the main channel and in a small tributary, respectively.

In Paradise Valley the potential for mudslides is small. Most of the slopes steep enough to engender mudslides are on nearly solid rock and have little soil mantle. Although there is a slight chance of damage from rock debris carried by streams flowing near the mountains, the hazard is minimal.

2.4 Flood Protection Measures

The Central Arizona Project (CAP), built under the jurisdiction of the U.S. Bureau of Reclamation, is designed to provide water from the Colorado River to the southeastern portion of Arizona. The Paradise Valley Detention Dike is part of the protective works for the Granite Reef Aqueduct portion of the CAP, and extends from Cave Creek Road (24th Street) to 1,000 feet west of Talieson West Lane (108th Street). This dike cuts off about 43 percent of the drainage area. This study takes into account the CAP and its effects on flooding in Paradise Valley.

Only a small amount of flood control work has been done within Paradise Valley. Indian Bend Channel improvements have been made by private subdivision developers from Invergordon Road north to the Paradise Valley corporate limits. Berneil Channel and a drainage ditch along Invergordon Road carry floodwaters to Indian Bend Wash. Berneil Channel has an east-west flow along the northern corporate limits. It intercepts sheet runoff and carries it to a north-south concrete-lined channel midway between Scottsdale Road and Invergordon Road. The portion of the channel which carries flow from the east has a capacity of 251 cfs; the reach carrying flow from the west along Mountain View Road has a capacity of about 3,000 cfs. Due to a flow control at the upstream end of the north-south channel, floodwaters in the channel, which carries flow from the east, will breakout and overtop the south levee for flows greater than 251 cfs.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence

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interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

For Indian Bend Wash, the peak discharges for the 25-, 50-, 100- and 500-year floods were reviewed and adopted from a COE report entitled Phoenix Urban Study, Final Report (Reference 4). These discharge values were plotted on log-probability paper and the 10-year peak discharge was determined by extrapolation. Since the 1979 Flood Insurance Study, the COE has finalized the Phoenix Urban Study (Reference 4), and the review indicated that future conditions within the Indian Bend Wash watershed will only affect the 500-year discharge.

For Berneil Channel, the flood discharges were taken from the Paradise Valley, Scottsdale, Phoenix (PVSP) Drainage Study (Reference 5). These peak discharges were utilized in place of the 1979 Flood Insurance Study peak flows for the following reasons:

A. The PVSP Drainage Study was financed, reviewed, and approved for its adoption by the communities of Paradise Valley, the City of Phoenix, and the City of Scottsdale. Furthermore, it was adopted by the Flood Control District of Maricopa County and Arizona Department of Water Resources.

B. Since the completion of the PVSP study, several flood control improvements have been built in accordance with the recommendations of the study.

The PVSP study only analyzed the 100-year storm condition and, therefore, only those values are included.

For Echo Canyon Wash, the flood discharges were taken from the previous Paradise Valley Flood Insurance Study (Reference 1).

Peak discharge-drainage area relationships for Indian Bend Wash, Echo Canyon Wash, and Berneil Channel are shown in Table 1.

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Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Indian Bend Wash					
At Shea Boulevard	23.92	2,700	8,500	13,000	27,000
At Double Tree Ranch Road	34.24	3,100	10,000	14,500	31,000
At Scottsdale Road	44.26	3,400	11,000	16,000	34,000
Berneil Channel					
At Scottsdale Road	3.0	--[1]	--[1]	1,251[2]	--[1]
Above Mountain View Ditch	6.0	--[1]	--[1]	1,424[2]	--[1]
Below Mountain View Ditch	10.1	--[1]	--[1]	3,997[2]	--[1]
Above confluence with Indian Bend Wash	10.6	--[1]	--[1]	4,189[2]	--[1]
Echo Canyon Wash					
At Tatum Road	1.9	1,200	2,550	3,600	8,650
At McDonald Drive	3.5	1,600	3,500	4,900	10,200

[1]Not computed

[2]Includes 1,000 cfs which breaches the channel causing sheetflow southerly

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to prov.de estimates of the elevations of floods of the selected recurrence intervals.

For Indian Bend Wash, the COE computer program HEC-2 was used to determine flood elevations (Reference 6). Cross sections were taken at required locations, using detailed topographic maps prepared from aerial photographs taken in December 1983 (Reference 7).

Manning's "n" values were determined based on field inspection. The values range from 0.020 to 0.40 for the channel and overbank of Indian Bend Wash.

The starting water-surface elevations were set at Scottsdale Road at levels established in the 1979 Flood Insurance Study (Reference 1).

The existing culvert at Scottsdale Road was not modeled, because of the accumulated debris and its small size. Effective flow areas for individual cross sections were accomplished using specified encroachment stations, Method 1 in the HEC-2 encroachment table (Reference 6).

For Berneil Channel, the COE computer program HEC-2 was used to determine flood elevations (Reference 6). This analysis also used other detailed maps prepared in 1983 (Reference 7).

Cross sections were taken at required locations along the channel. Mannings "n" values were determined based on field inspection. The values range from 0.017 to 0.035 for the channel and overbank of Berneil Channel. The starting water-surface elevation was set at the confluence with Indian Bend Wash as normal depth. Effective flow areas for individual locations were accomplished using specified encroachment stations, Method 1 in the HEC-2 encroachment table (Reference 6).

The 100-year discharge was the only discharge studied for Berneil Channel. The 100-year flooding in the channel is designated as Zone A. Profiles are not presented because the Zone A boundaries are contained entirely in the channel within the Town of Paradise Valley, and water leaving Berneil Channel only causes shallow flooding.

Hydraulic analysis of Berneil Channel using the HEC-2 step-backwater program showed that the levee of the unimproved upstream channel would overtop. An analysis of various locations of the channel determined that a location 2,560 feet downstream of Scottsdale Road was the controlling point. Any discharge greater than 3,000 cfs in the north-south channel would result in breaching of the channel and sheetflow to the south.

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Normal-depth calculations determined that the average depths in the sheetflow area were less than 1.0 foot.

For Echo Canyon Wash, the COE computer program HEC-2 was used to determine flood elevations (Reference 6). Cross section data were obtained from topographic maps at a scale of 1:1,200, with a contour interval of 2 feet (Reference 8). Manning's "n" values were established on the basis of field investigations. Values ranged from 0.018 to 0.025 for the channel and from 0.012 to 0.035 for the overbanks. The starting water-surface elevations were determined using the slope-area method (Reference 9).

For the Arizona Canal, it was assumed that the top of the canal embankment would be the maximum pending elevation on the upslope side of the canal. These elevations were projected upslope to intersect natural ground and determine the flood hazard areas, using USGS topographic maps at a scale of 1:24,000, contour interval 20 feet (Reference 10). On the downslope side of the Arizona Canal an analysis was performed to determine the distance required for flow through a break in the levee to spread and be reduced to an average depth of 1 foot, using Manning's equation.

Roughness coefficients (Manning's "n") were determined from field inspection and engineering judgment. The value of the roughness coefficient for the Arizona Canal overbank is 0.080.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program (NFIP) encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For Indian Bend Wash the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800, with a contour interval of 4 feet (Reference 7).

For Berneil Channel, the 100-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using the detailed topographic maps prepared in 1983 (Reference 7).

For the Berneil Channel breakout delineation, the USGS topographic map at a scale 1:24,000, contour interval 20 feet was used where detailed mapping was not available (Reference 10).

For Echo Canyon Wash, the 100- and 500-year flood boundaries were determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:1,200, with a contour interval of 2 feet (Reference 8).

For Arizona Canal, the 100-year flood boundaries were determined based on USGS topographic maps at a scale of 1:24,000 and a contour interval of 20 feet (Reference 10).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

Because Arizona Canal was studied by approximate methods, only the 100-year flood plain boundary is shown.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood

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plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

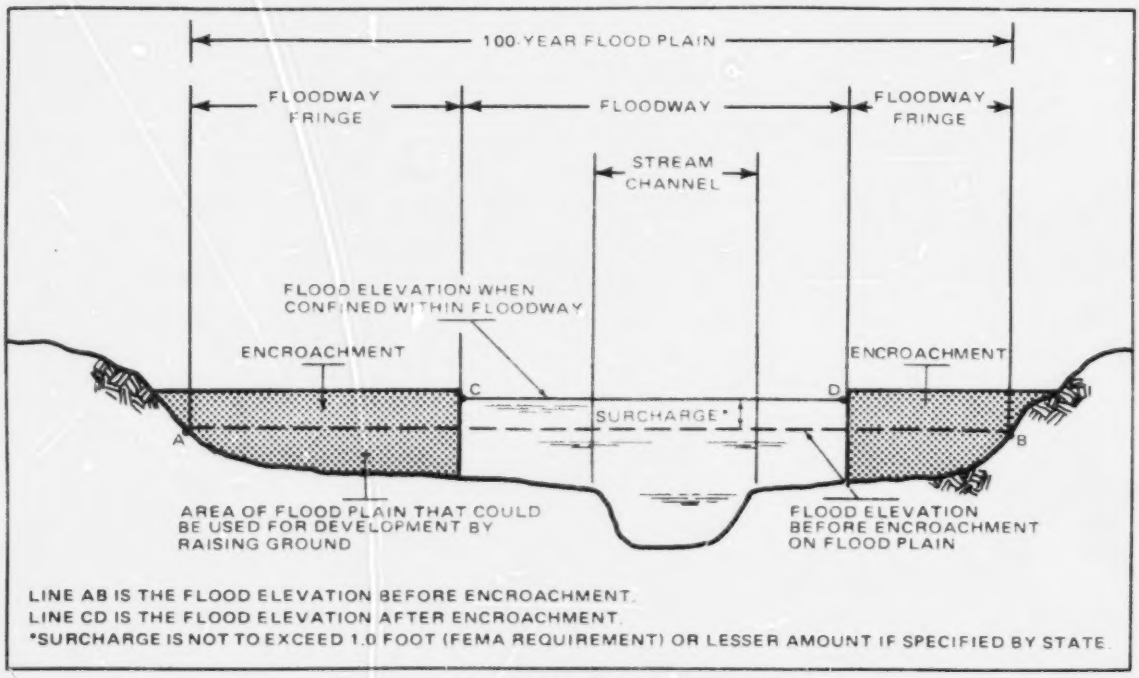
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Indian Bend Wash								
J	8.440	870[2]	2,026	7.9	1,298.7	1,298.7	1,299.0	0.3
K	8.520	710	2,880	5.6	1,300.3	1,300.3	1,300.8	0.5
L	8.630	740	3,496	4.6	1,301.3	1,301.3	1,302.2	0.9
M	8.820	800	2,855	5.6	1,303.8	1,303.8	1,304.6	0.8
N	9.000	710	3,289	4.9	1,307.6	1,307.6	1,307.6	0.0
O	9.190	760	2,894	5.5	1,310.0	1,310.0	1,310.2	0.2
P	9.390	725	2,291	7.0	1,314.6	1,314.6	1,314.6	0.0
Q	9.580	688	3,321	4.8	1,317.7	1,317.7	1,317.9	0.2
R	9.690	780	3,171	5.0	1,318.7	1,318.7	1,318.8	0.1
S	9.723	706	2,060	7.8	1,319.0	1,319.0	1,319.1	0.1
T	9.724	746	2,330	6.9	1,319.2	1,319.2	1,319.2	0.0
U	9.770	652	3,999	4.0	1,320.1	1,320.1	1,320.1	0.0
V	9.950	648	1,797	8.9	1,321.7	1,321.7	1,321.7	0.0
W	10.140	637	3,412	4.7	1,325.3	1,325.3	1,325.3	0.0
X	10.330	652	1,719	8.4	1,327.1	1,327.1	1,327.1	0.0
Y	10.400	684	3,049	4.8	1,329.2	1,329.2	1,329.2	0.0
Z	10.453	666	2,159	6.7	1,329.4	1,329.4	1,329.4	0.0
AA	10.454	595	1,779	8.2	1,329.4	1,329.4	1,329.4	0.0
AB	10.530	670	1,807	8.0	1,331.5	1,331.5	1,331.5	0.0
AC	10.720	651	2,387	6.1	1,336.5	1,336.5	1,336.5	0.0
AD	10.930	629	2,622	5.5	1,339.4	1,339.4	1,339.4	0.0
AE	11.090	659	1,683	8.6	1,342.8	1,342.8	1,342.8	0.0
AF	11.120	645	2,303	6.3	1,344.1	1,344.1	1,344.1	0.0
AG	11.310	658	3,408	4.3	1,346.2	1,346.2	1,346.2	0.0
AH	11.520	441	1,415	10.2	1,350.8	1,350.8	1,350.8	0.0

[1]Miles Above Mouth [2]Width Extends Beyond Corporate Limits

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PARADISE VALLEY, AZ
(MARICOPA CO.)

FLOODWAY DATA

INDIAN BEND WASH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Echo Canyon Wash								
A	1,200	400	750	7.9	1,258.7	1,258.7	1,258.7	0.0
B	1,940	200	680	8.8	1,264.3	1,264.3	1,264.6	0.3
G	7,730	150	635	7.8	1,308.4	1,308.4	1,308.9	0.5
H	8,040	150	377	11.9	1,310.2	1,310.2	1,310.7	0.5
I	8,260	150	734	6.1	1,314.4	1,314.4	1,314.4	0.0
J	8,610	150	774	5.8	1,316.1	1,316.1	1,316.1	0.0
K	9,160	150	729	6.2	1,317.6	1,317.6	1,318.0	0.4
L	10,000	150	451	8.0	1,321.9	1,321.9	1,322.8	0.9
M	10,800	150	609	4.9	1,327.5	1,327.5	1,327.5	0.0

[1]Feet above Confluence with the Arizona Canal

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PARADISE VALLEY, AZ
(MARICOPA CO.)

FLOODWAY DATA

ECHO CANYON WASH

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5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the Town of Paradise Valley.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Paradise Valley are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

For the Berneil Channel, no reach determinations were made. Reach determinations, for insurance purposes, would have no relevance in a defined channel.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Indian Bend Wash							
Reach 1	1680,1690, 1695	-2.64	-0.77	2.14	025	A5	Varies - See Map
Echo Canyon Wash							
Reach 1	1690	-1.8	-1.0	2.1	020	A4	Varies - See Map
Reach 2	1690	-2.6	-1.7	2.5	025	A5	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PARADISE VALLEY, AZ
(MARICOPA CO.)

FLOOD INSURANCE ZONE DATA

INDIAN BEND WASH-ECHO CANYON WASH

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5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A4 and A5:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flood hazard; not subdivided.

The flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Paradise Valley is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

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6.0 OTHER STUDIES

A Flood Insurance Study for Paradise Valley was prepared in 1976 (Reference 11). However, the 1976 study did not take into account the U.S. Bureau of Reclamation water-resources project known as CAP. The CAP primarily affects Indian Bend Wash. The Flood Insurance Study prepared in 1979 (Reference 1) employs information contained in the 1976 study, but updates the portions dealing with Indian Bend Wash.

Flood Insurance Studies have been completed for the Cities of Phoenix and Scottsdale, adjacent to Paradise Valley (References 9 and 12). The Flood Insurance Study for the unincorporated areas of Maricopa County, Arizona, is being revised (Reference 13).

Work on these studies have been coordinated to ensure agreement of results across municipal boundaries.

This study is authoritative for purposes of the NFIP; the data presented herein either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Building 105, Presidi of San Francisco, San Francisco, California 94129.

8.0 BIBLIOGRAPHY AND REFERENCES

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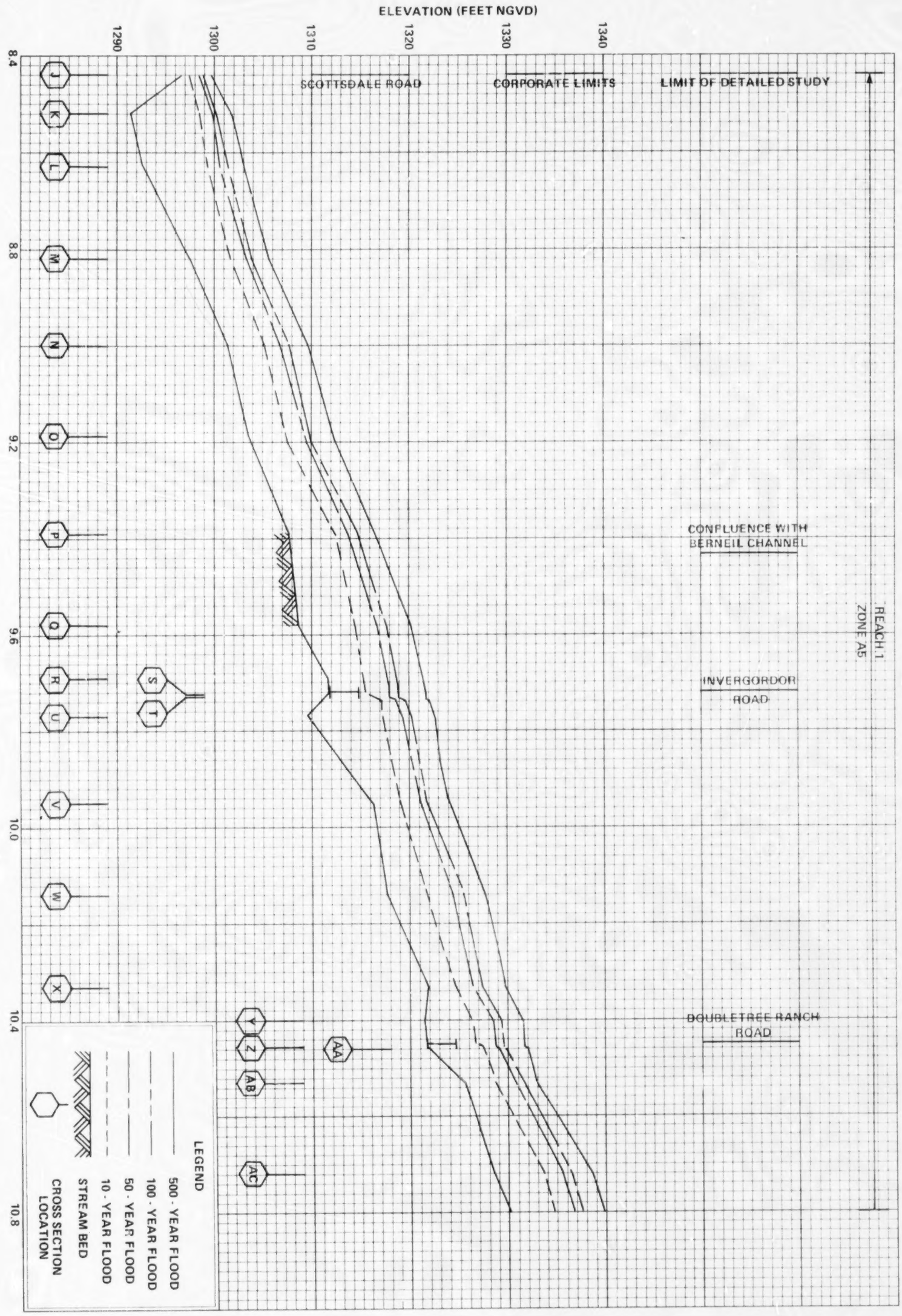

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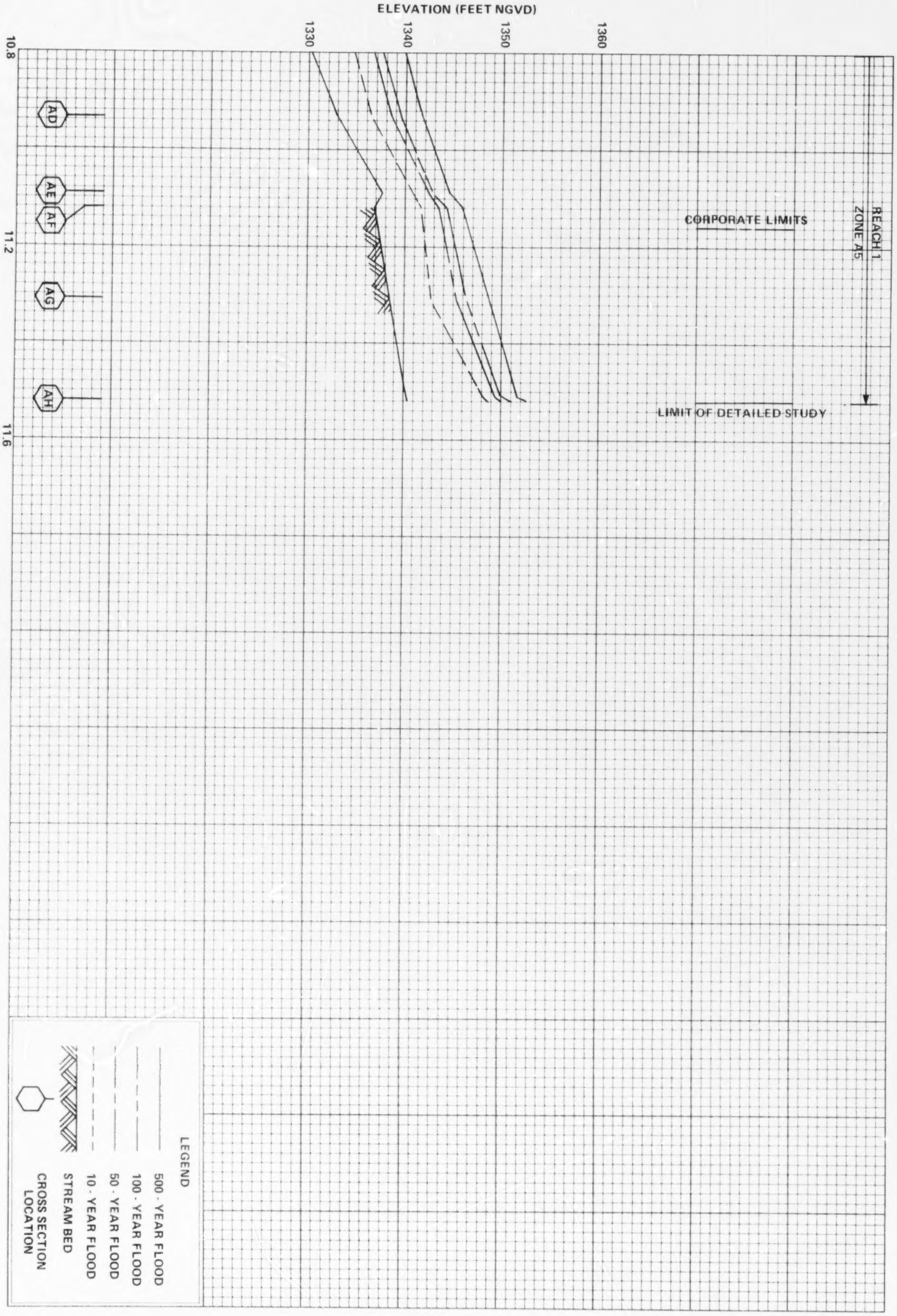

02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PARADISE VALLEY, AZ
(MARICOPA CO.)

FLOOD PROFILES

INDIAN BEND WASH

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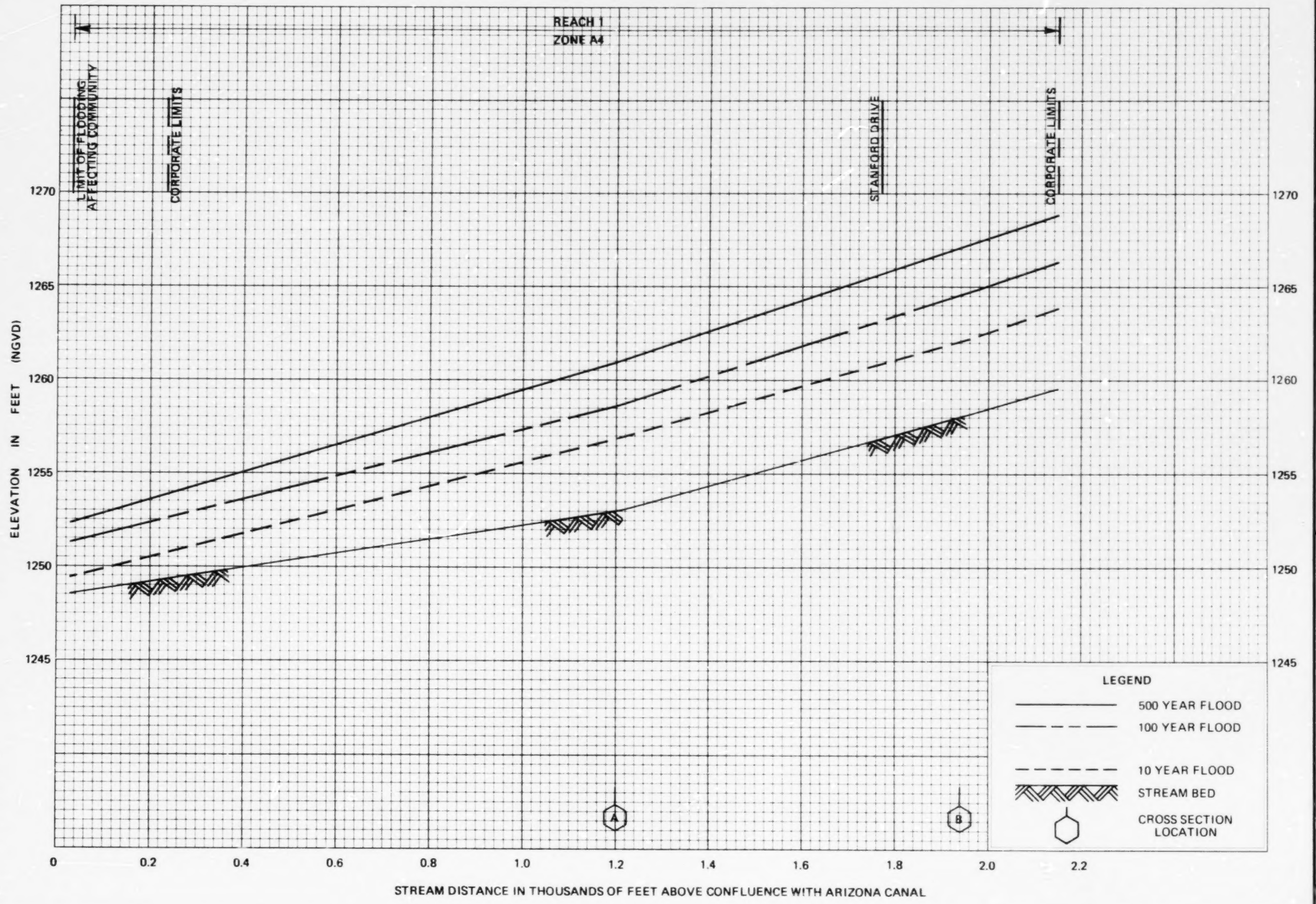

FLOOD PROFILES

ECHO CANYON WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF PARADISE VALLEY, AZ
(MARICOPA CO.)

03P

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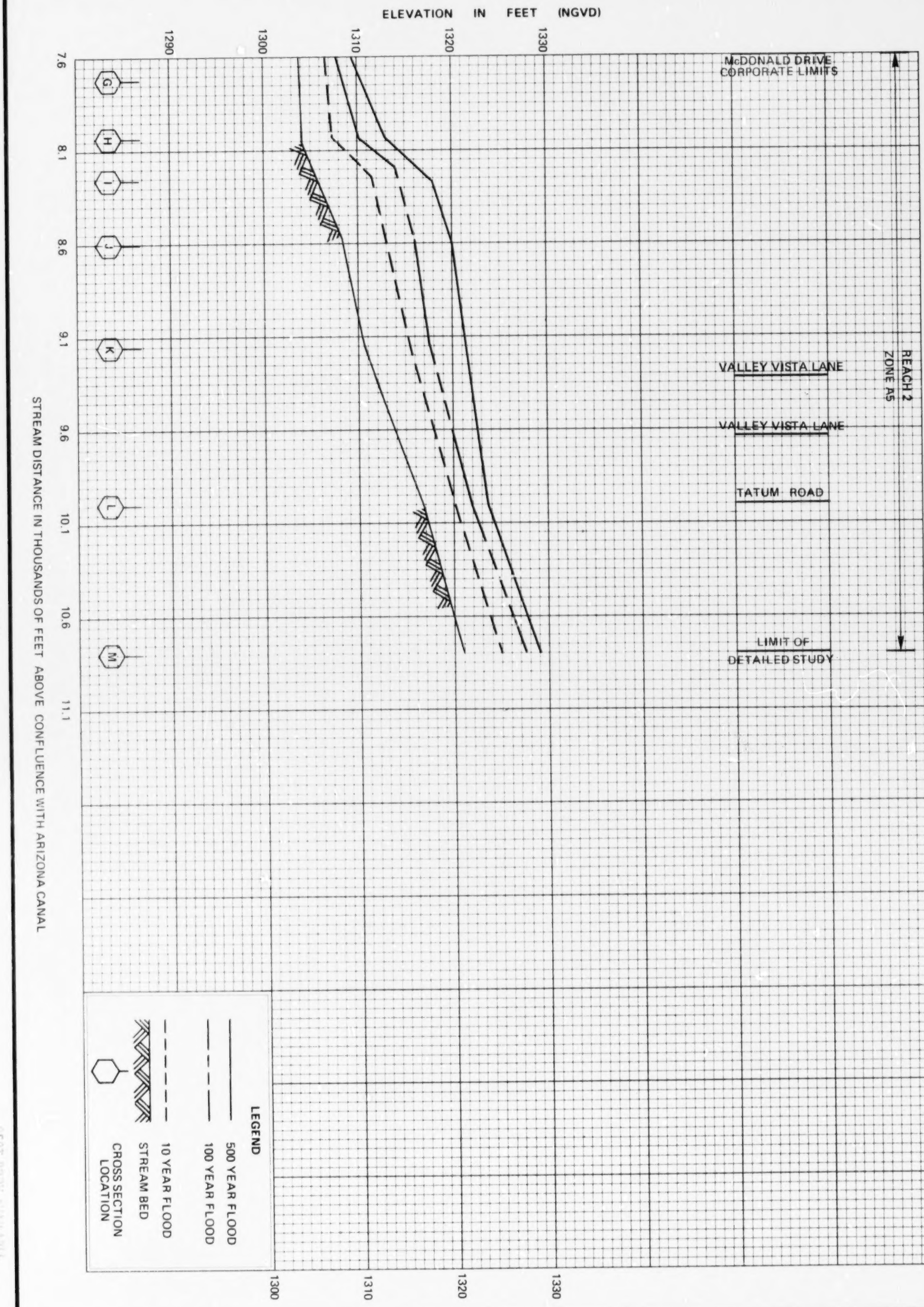

04P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWN OF PARADISE VALLEY, AZ** (MARICOPA CO.)	**FLOOD PROFILES** **ECHO CANYON WASH**

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